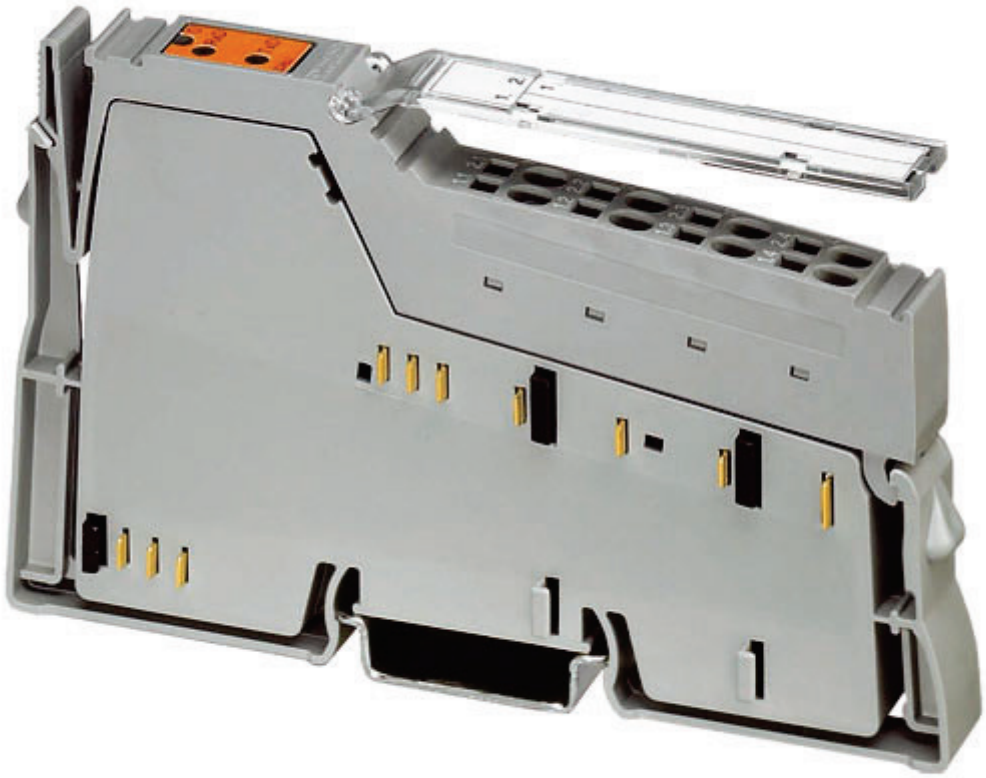
Inline Terminal
ILT DALI

Device Description



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1 Overview

The terminal ILT DALI is a DALI master for use within the modular Inline-I/O system of Phoenix Contact.

It is used to control lamps via DALI ballasts according to IEC 60929. As defined in this DALI standard, up to 64 ballasts can be individually addressed.

Running a DALI system with this terminal requires an additional DALI bus supply, for example a terminal ILT DALI/PWR or a suitable external power supply.

Features:

- DALI master without integrated DALI bus supply
- designed for single master operation
- safe insulation of the DALI bus
- DALI bus protected against mistakenly connecting mains (up to 250 V AC)
- can be used as extension to a terminal ILT DALI/PWR (part no. 1225-100251-05-6), using the built-in supply of this terminal
- alternatively, a suitable external DALI bus power supply can be used
- communication on local bus via process data
- indicators for diagnostics, transmission and reception

Note: This description is only valid in association with the user manual ILT INST PRO UM of Phoenix Contact (see [1]).

2 Order Information

Device	Part number
ILT DALI	1225-100252-05-3

Table 2.1: Order Information

3 Connections

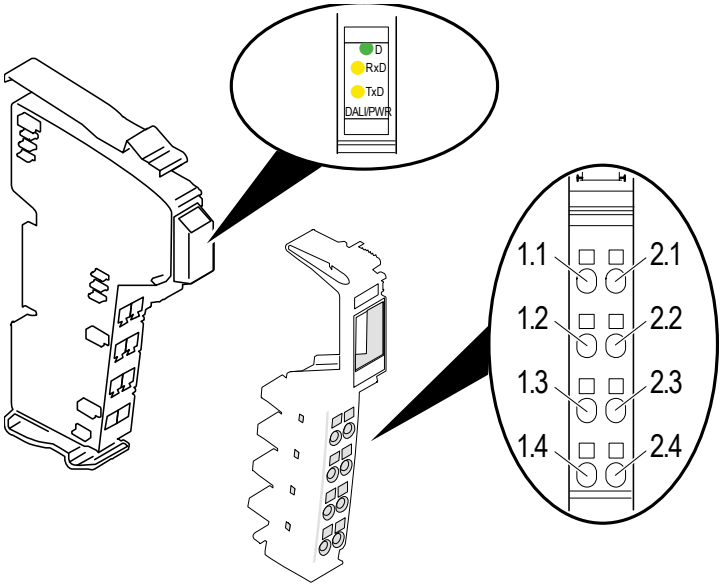

Fig. 3.1: Terminal connections

Indicator	Color	Descriptiong
D	green	Bus diagnostics
RxD	yellow	Terminal is receiving data from DALI bus
TxD	yellow	Terminal is sending data to DALI bus

Table 3.1: Local diagnostic and status indicators

Terminal point	Signal	Assignment
1.2, 2.2	DA+	DALI bus (positive)
1.3, 2.3	DA-	DALI bus (negative)

Table 3.2: Terminal assignment

Note: Terminal points 2.2 and 2.3 are not available on the device itself. They are internally connected to 1.2 and 1.3 inside the connector.

Terminal points not defined in table 3.2 must not be used.

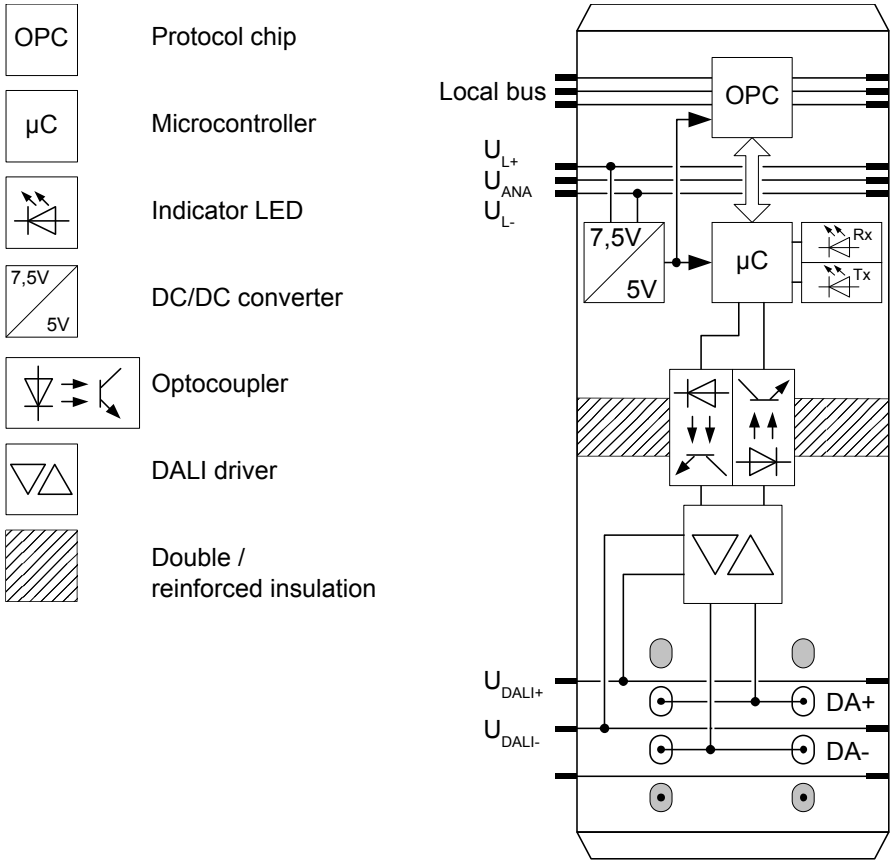

Fig. 3.2: Functional overview

3.1 Wiring Guidelines

The voltage drop between transmitter and receiver on the DALI bus must not exceed 2 V at 250 mA. Table 3.1.1 shows wiring recommendations. The maximum lead length between two connected DALI devices should not exceed 300 m.

Lead length	Minimum cross section
< 100 m	0.5 mm² (AWG 20)
100..150 m	0.75 mm² (AWG 18)
> 150 m	1.5 mm² (AWG 15)

Table 3.1.1: Recommended cross sections of DALI bus wiring

Special bus cables (twisted or shielded) are not needed. Linear, star shaped and mixed structures are applicable. Ring shaped structures should be avoided.

DALI interface insulation of the electronic ballasts fulfills the requirements of base insulation only. Therefore, SELV (Safety Extra Low Voltage) is not granted on the DALI bus, despite the safe insulation of the ILT DALI.

3.2 Wiring Example

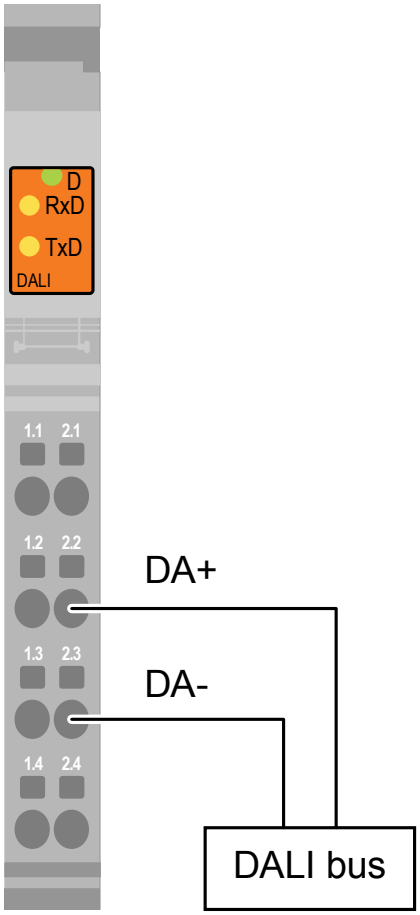

Fig. 3.2.1: Wiring example (without terminal ILT DALI/PWR and without end terminal)

The terminal ILT DALI is typically used as extension to a terminal ILT DALI/PWR (part no. 1225-100251-05-6). Up to 3 DALI extension terminals can be supplied by one terminal ILT DALI/PWR.

Alternatively, the DALI bus supply can be accomplished directly via the DALI bus, for example using a suitable power supply or other DALI devices with integrated power supply.

Following conditions have to be met on the DALI bus:

- supply voltage 9.5 V to 22.5 V DC at supply current of at least 135 mA (for full load with 64 DALI ballasts)
- total short circuit current ≤ 250 mA, response time less than 10µs

Note: The DALI bus must be supplied either via the potential routing contact U_{DALI} or directly at the DALI bus (not both)!

Observe polarity when connecting external DALI bus supply to the terminal ILT DALI! In this case, the terminal must be isolated from both sides using separation terminals ILT DOR LV-SET.

3.3 Typical Terminal Arrangement

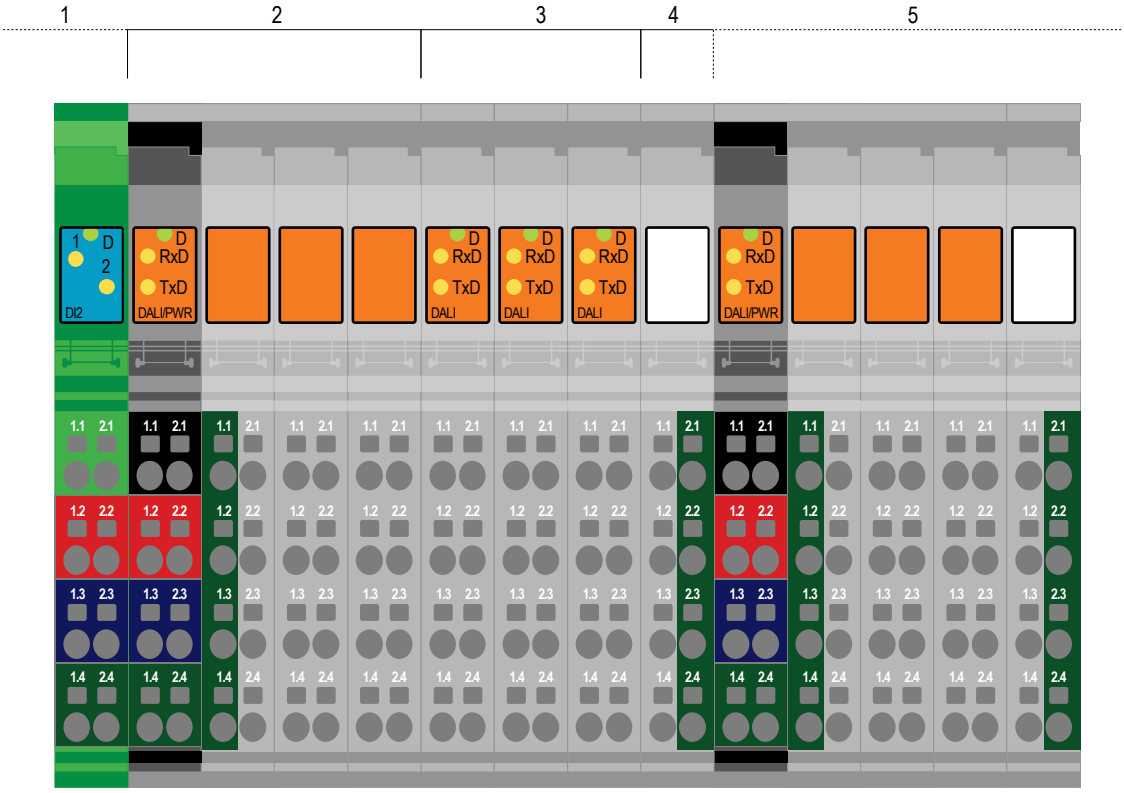

Fig. 3.3.1: Typical Inline station with several DALI terminals

Figure 3.3.1 shows a typical station using DALI terminals. The station consists of several sections:

1. 24 V section
2. Terminal ILT DALI/PWR. The DALI bus supply is fed from the preceding 24 V section via the potential routing contact (U_M). U_M and GND of connector 1 are not used.
3. Up to 3 extension terminals ILT DALI. The DALI bus supply of these DALI masters is fed from the preceding terminal ILT DALI/PWR via the potential routing contacts U_{DALI}.
4. Separation terminal of the DALI section as end terminal. The separation terminal is included in delivery of terminal ILT DALI/PWR. In any case this end terminal is required for proper termination of this DALI section – no matter how many extension terminals (0-3) are used!
5. Next DALI section, starting with terminal ILT DALI/PWR, in example without extension terminals. Because this terminal is not preceded by a 24 V section (that is, no 24 V DC is available via the potential routing contact U_M) the DALI bus supply must be fed via terminal points 1.2 and 1.3 (or 2.2 and 2.3) of connector 1. The necessary 24 V DC could be tapped at connector 1 of section 2 (observe max. allowed currents). Of course, this DALI section has to be terminated by an separation terminal as end terminal, too.

Important: Every DALI section has to be terminated by the end terminal (included in delivery of terminal ILT DALI/PWR). Otherwise the electrical insulation between U_M / U_S and the DALI bus might be compromised!

Note: The DALI busses of section 2 and 3 in fig. 3.3.1 are electrically not insulated among one another. Normally this is no problem. However, if such an insulation is required, the terminal ILT DALI/PWR can not be extended by terminals ILT DALI.

On the other hand, the DALI busses of sections 2 and 3 are electrically insulated from the DALI bus in section 5, even if all sections use the same 24 V DC supply U_M.

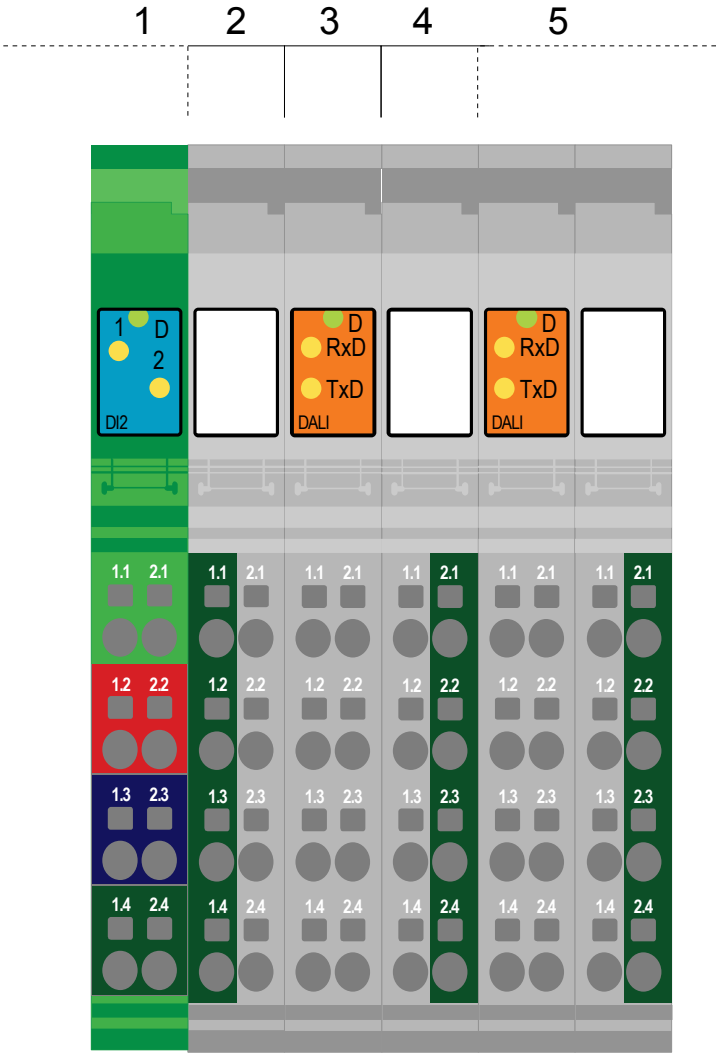

Fig. 3.3.2: DALI Inline station when using external DALI bus supply

Fig. 3.3.2 shows the station set up for using external DALI power supplies. The supply is accomplished by directly connecting to the DALI bus, for example at the DALI terminal (observe polarity). The station consists of the sections:

1. 24 V section
2. separation terminal ILT DOR LV-SET
3. terminal ILT DALI
4. separation terminal ILT DOR LV-SET
5. next terminal ILT DALI

If the DALI terminals are following a 230 V section, the same setup applies. However, the first separation terminal is then rather considered being the end terminal of the 230 V section.

Important Note: Every externally supplied DALI terminal, has to be isolated from both sides using a separation terminal set ILT DOR LV-SET (part no. 28 61 64 5; set contains 2 separation terminals). Otherwise there were inadmissible connections due to the potential routing contacts U_{DALI}.

The DALI terminal is polarity dependent. Please observe polarity, when connecting an external power supply.

4 Communication

4.1 Programming Data/Configuration Data

Attribute	Value
ID code	BF_{hex} (191_{dez})
Length code	02_{hex} (2_{dez})
Input address area	2 words
Output address area	2 words
Parameter channel (PCP)	0 byte
Register length (bus)	2 words

Table 4.1.1: INTERBUS programming data / configuration data

4.2 Process Data Structure

Output process data word OUT1															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	TB	command			0	0	0	0	0	0	0	0

Table 4.2.1: Structure of output process data word OUT1

Bit			Command	Description
10	9	8		
0	0	0	idle	DALI bus idle
0	0	1	send	send DALI command
0	1	0	repeat	send DALI command and repeat after 50 ms
0	1	1	reserved	
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Table 4.2.2: Command field in OUT1

Bit 11 (TB – Toggle Bit) of process data word OUT1 is used, when commands with the same command field shall be sent consecutively.

Output process data word OUT2															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
address byte								S = 0: data byte S = 1: command byte							
Y	A	A	A	A	A	A	S								

Table 4.2.3: Structure of output process data word OUT2

Input process data word IN1															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SB	K	AW	F	TB	command			answer							

Table 4.2.4: Structure of input process data word IN1

Input process data word IN2															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
address byte								S = 0: data byte S = 1: command byte							
Y	A	A	A	A	A	A	S								

Table 4.2.5: Structure of input process data word IN2

The input proces data words are mirroring the output words. Possible differences at IN1:

- SB indicates a peripheral fault (failure of DALI supply, short circuit on DALI bus or failure of DALI driver circuitry)
- K is set, when an unsupported command has been received via INTERBUS local bus (no action on DALI bus)
- AW is set, when a valid response of the DALI ballast has been received. The answer field is to be interpreted in this case only (otherwise as in OUT1)
- F is set, when an invalid response of the DALI ballast has been received (e.g. interference on DALI bus)

4.3 Functional Description

Incoming process data words are checked by the DALI terminal for changes of the command byte (most significant byte of OUT1). For that reason, the toggle bit is usually inverted by the application of the INTERBUS master for each new DALI transaction.

OUT2 contains the complete DALI command to be sent on the DALI bus. The data word in OUT2 is not interpreted in any way by the DALI terminal.

The terminal starts sending OUT2 to the DALI bus when:

- a change of the command byte has been detected, and
- the command byte contains a valid command "send" or "repeat", and
- the DALI bus is idle (previous transaction on DALI bus completed)

Following the transmission, the terminal waits about 10 ms for an answer of the DALI slave and receives it, should the occasion arise.

Finally, the terminal copies the process data words OUT 1/2 to the process data words IN 1/2 and modifies the status bits SB, K, AW and F as well as the answer byte accordingly. This acknowledgement indicates that the terminal is ready for the next command.

When a valid DALI answer has been received, the terminal waits another ~10 ms (DALI bus settling time). Bit AW of the acknowledgement will be set and the DALI answer will be copied to the least significant byte of OUT1.

The command "repeat" sends the DALI command in OUT2 two times at an interval of 50 ms (start of first transmission to start of second transmission). Beside of this, the processing is similar to the command "send".

A few DALI commands require double sending. Using the command "repeat", this can be achieved independent of the bus cycles of the INTERBUS local bus.

5 Technical Data

General data		
Housing dimensions (width x height x depth)		12.2 mm x 120 mm x 71.5 mm (0.48 in. x 4.724 in. x 2.815 in.)
Weight with connectors		60 g
Operating mode		process data operation with 2 words
Permissible temperature	operation	-25 °C to +55 °C (-13 °F to +131 °F)
	storage / transport	-25 °C to +85 °C (-13 °F to +185 °F)
Permissible humidity		75% on average, 85% occasionally (non condensing)
Permissible air pressure	operation	80 kPa to 106 kPa (up to 2000 m / 6562 ft.above sea level)
	storage / transport	70 kPa to 106 kPa (up to 3000 m / 9843 ft. above sea level)
Degree of protection		IP20 according to IEC 60529
Inline connector		
Connection type		spring-clamp
Rated cross sectioin		0,2 mm² to 1,5 mm², AWG 24 - 16
Insulation stripping length		8 mm

Interfaces	
Local bus	
Connection	through data routing
Transmission speed	500 kBit/s
DALI general	
Data rate	1200 Bit/s
Protection	bus protected up to 250 V AC
DALI when supplied by ILT DALI/PWR (via potential routing contacts)	
Bus supply voltage	typ. 14 V
Output current in short circuit	≤ 250 mA
max. bus load	128 mA observe derating of supply terminal ILT DALI/PWR

Power consumption	
Communications power U_L	7.5 V
Current consumption at U_L	≤ 38 mA

Power dissipation
Equation to calculate the power dissipation in the terminal $P_{EL} = P_{BUS} + P_{DRV}$ P_{BUS} = 0.27 W $P_{DRV\ max}$ = 0.56 W + I_{DALI} (I_{DALI} x 3.85 Ω + 0.47 V) P_{DRV_ICS} = 0.37 W + I_{DALI} (I_{DALI} x 4.7 Ω + 0.58 V) Where P_{EL} total power dissipation in the terminal P_{BUS} power dissipation through bus operation P_{DRV} power dissipation through DALI bus-driver, depends on DALI bus load and bus activity (idle, transmit, receive) P_{DRV_ICS} typical power dissipation of bus driver, when using buscontrollers of the Inline Control Server family ICS I_{DALI} DALI bus load of the terminal ILT DALI, typ. 2 mA per DALI slave

Protective equipment	
Overvoltage protection on DALI bus	varistor 275 V
Short circuit on DALI bus	electronic fuse, no time limit

Electrical Isolation / Isolation of the voltage areas	
Common potentials	
DALI supply voltage U_{DALI} and DALI bus have the same potential.	
Separate potentials in the terminal ILT DALI/PWR	
Test distance	**Test voltage**
7.5 V supply (bus logic) vs. DALI bus routine test	2500 V AC, 50 Hz, 1 min 1200 V AC, 50 Hz, 1 min

Error messages to higher-level control system
Peripheral error in case of DALI supply error or short circuit of DALI bus

Table 5.1: Technical data

6 Literature

[1] User manual IL SYS INST UM E: "Automation Terminals of the Inline Product Range", Phoenix Contact,
Phoenix Contact order no. 2698737

[2] User manual ILT SYS PRO UM: "Configuring and Installing the INTERBUS Inline Product Range", Phoenix Contact,
Phoenix Contact order no. 2743048

[3] IEC 60929, appendix E.4

[4] DALI Manual, DALI AG, www.dali-ag.org

[5] www.phoenixcontact.com

[6] www.sysmik.de